CLAIMS:

What is claimed is:

1. A peptide amphiphile composition comprising:

    a hydrophobic component; and

    a hydrophilic component covalently bonded to said hydrophobic component in said peptide amphiphile, said hydrophilic component having a net charge at physiological pH, said peptide amphiphile self assembling to form a micelle.

2. The peptide-amphiphile compositions of claim 1, wherein the net charge on the peptide amphiphile is positive.

3. The peptide-amphiphile compositions of claim 1, wherein the net charge on the peptide amphiphile is negative

4. The composition of claim 3, wherein the negative net charge on the peptide amphiphile is from -4 to -7

5. The composition of claim 3, wherein the negative net charge on the peptide amphiphile is -7 or more negative.

6. The composition of claim 3, wherein the hydrophilic portion includes an amino acid is selected from the group consisting of serine, phosphorylated serine, and aspartic acid.

7. The composition of claim 1, wherein the peptide component of said peptide-amphiphile includes a residue with a functional moiety capable of intermolecular covalent bond formation.

8. The composition of claim 7, wherein said residue is cysteine.

9. A peptide-amphiphile compound comprising:

    an alkyl tail;

a structural peptide covalently bonded to said alkyl tail; and

a functional peptidecovalently bonded to said structural peptide opposite said alkyl tail; said functional peptide having an overall conical shape and a net charge at physiological pH.

10. The peptide-amphiphile compound of claim 9, wherein said functional peptide amphiphile has a positive net charge.

11. The peptide-amphiphile compound of claim 9, wherein said functional peptide amphiphile has a negative net charge.

12. The compound of claim 11, wherein the negative net charge on the peptide amphiphile is from -4 to -7.

13. The compound of claim 11, wherein the negative net charge on the peptide amphiphile is more negative than -7.

14. The compound of claim 11, wherein the functional peptide includes an amino acid selected from the group consisting of serine, phosphorylated serine, and aspartic acid.

15. The compound of claim 11, wherein the structural peptide includes a residue with a functional moiety capable of intermolecular covalent bond formation.

16. The compound of claim 15, wherein said residue is cysteine.

17. A composition comprising:

an aqueous solution of at least one charged peptide amphiphile, said charged peptide amphiphile having a hydrophobic segment covalently bonded to a hydrophilic segment, said peptide amphiphile having a net charge at substantially physiological pH; and

an agent for inducing said charged peptide amphiphiles to self assemble into a micelle.

18. The composition of claim 17, wherein the net charge of said peptide amphiphile is positive.

19. The composition of claim 17, wherein the net charge of said peptide amphiphile is negative.

20. The composition of claim 17 wherein the agent includes solvent removal from the peptide amphiphile solution.

21. The composition of claim 19, wherein the agent inducing self assembly is chosen from the group consisting of oppositely charged peptide amphiphiles, cations, anions, .

22. A composition comprising:

one or more nanofibers formed from charged self assembled peptide amphiphiles, said peptide amphiphiles having a hydrophobic segment covalently bonded to a hydrophilic segment, said peptide amphiphile having a net absolute charge greater than 3 at substantially physiological pH.

23. The composition of claim 22 further including a substrate, said nanofibers covering at least a portion of said substrate.

24. The composition of claim 22 further including osteoblastic cells on said nanofibers.

25. The composition of claim 22 further including a crystalline material having a crystal axis preferentially oriented with respect to the length of said nanofiber.

26. The composition of claim 22 further including osteoblastic cells and a mineral on said nanofibers.

27. The composition of claim 22 wherein said nanofibers are preferentially oriented on at least a portion of the substrate.

28. A method of treating a patient with tissue engineered material comprised of:

administering a peptide amphiphile composition to a site on said patient in need thereof, said peptide amphiphile capable of stimulating mineralization of said site, said peptide amphiphile compositions having a net charge at physiological pH.

29. The method of claim 28, wherein said net charge on the peptide amphiphile is positive.

30. The method of claim 28, wherein said net charge on the peptide amphiphile is negative.

31. The method of claim 30, wherein the negative net charge on the peptide amphiphile is –4 or more negative.

32. The method of claim 30, further comprising the step of adding an agent to induce self assembly of said peptide amphiphiles at said site.

33. The method of claim 28, wherein peptide-amphiphile includes an amino acid selected from the group consisting of serine, phosphorylated serine, and aspartic acid.

34. The method of claim 28, wherein the peptide-amphiphile includes a residue with a functional moiety capable of intermolecular covalent bond formation.

35. The method of claim 34, wherein the functional moiety is cysteine.

36. A mineralizable bone-defect filler composition comprised of:

a peptide-amphiphile compound which itself includes an alkyl tail covalently bonded to a first end of a structural peptide segment, and a functional peptide covalently bonded to a second end of said structural peptide segment; said functional peptide having a negative net charge at physiological pH; and

cation and anion constituents of a biomineral.

37. The composition of claim 36, wherein the net charge on the peptide amphiphile is –4 or more negative .

38. The composition of claim 36, wherein the cation includes Ca^{+2}.

39. The composition of claim 36, wherein the functional peptide includes an amino acid selected from the group consisting of serine, phosphorylated serine, and aspartic acid.

40. The composition of claim 36, wherein the peptide amphiphiles are self assembled.